Health Consultation

Evaluation of Contaminants: Domestic wells near Bainbridge Island Landfill (June 1999 Sampling data)

Kitsap County, Washington

CERCLIS # WAD980978720

August 1999

Prepared by
Washington State Department of Health
under cooperative agreement with the
Agency for Toxic Substances and Disease Registry

FOREWORD

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This Health Consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of this Health Consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. The Health Consultation allows DOH to respond quickly to a request from concerned residents for health information on hazardous substance. It provides advice on specific public health issues. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommendations actions to protect public health.

For additional information or questions regarding DOH, ATSDR, or the contents of this Health Consultation, please contact the preparer of this report:

Paul Marchant, Public Health Assessor
Washington State Department of Health
Office of Environmental Health Assessments
P.O. Box 47825
Olympia, WA. 98504-7825
(360) 236-3375
Fax (360) 236-3383
Toll free: 1-877-485-7316

BACKGROUND AND STATEMENT OF ISSUES

In the spring of 1998, the Washington State Department of Ecology (Ecology) asked the Washington State Department of Health (DOH) to evaluate potential health threats from a 1 to 5 year exposure to low levels of vinyl chloride and other contaminants detected in domestic water supply wells in the vicinity of the Bainbridge Island Landfill in Kitsap County, Washington. This health consultation is the sixth in a series of health consultations prepared by DOH which summarizes our evaluation of the public health implications resulting from actual or potential exposure to these contaminants. The five previous health consultations prepared by DOH evaluated and summarized the results of domestic well samples collected near the landfill between April 1996 and March 1999. DOH concluded that *no apparent public health hazard existed from exposure to contaminants detected in any of the wells during these sampling periods*. The no apparent public health hazard category is used for sites where human exposure to contaminated media (i.e.-water) is occurring or has occurred in the past, but the exposure is below a level of health hazard.

As part of the ongoing Bainbridge Island Landfill Remedial Investigation (RI), during the June 1999 sampling event, the Kitsap County Department of Public Works collected water samples from 9 monitoring wells at the landfill and 13 water supply wells located in the vicinity of the landfill to evaluate water quality. Samples have been collected over every season. The primary contaminant of concern in the domestic wells (and the only contaminant of concern since June 1998) has been vinyl chloride. Since March 1998, vinyl chloride concentrations have progressively declined to their current, (and lowest), concentration to date (Table 2).

Should future water supply well contaminant concentrations approach or reach levels of health concern (i.e.- if concentration trends reverse), or if new contaminants are detected in subsequent domestic well samples that could threaten public health, DOH can prepare another health consultation report summarizing the risks. If concentrations should increase to levels that could threaten public health, DOH or the Bremerton/Kitsap County Health District will notify well users immediately.

For the reasons stated above, this will be DOH's final written Health Consultation report. However, DOH will continue to evaluate the results of subsequent quarterly domestic well sampling data over the next few years, and consult with Ecology and the Bremerton/Kitsap County Health District about the findings and recommendations.

For more detailed information about the Landfill investigation, the reader can refer to the RI report for the Bainbridge Island Landfill.

METHODS

The reader can refer to the previous DOH health consultations for a detailed description of the methods used by DOH to evaluate data.

DATA SUMMARY

A total of 13 domestic wells were sampled by the Kitsap County Department of Public Works during the June 1999 sampling event. Sampling analysis included VOCs and conventionals (total organic carbon, temperature, nitrate, pH, alkalinity, chloride, total dissolved solids, dissolved oxygen, sulfate, etc.) for all 13 wells. No other chemical groups were analyzed during the June 1999 sampling event.

Five VOCs were detected at low levels during the June sampling round, although vinyl chloride was the only one which slightly exceeded an ATSDR screening value. Contaminants detected below ATSDR screening values are unlikely to pose a public health threat and will not not be discussed further in the health consultation. Table 1 lists the domestic wells with the single highest chemical detections, each chemical's health-based screening value, well ID, and approximate number of residences served by the well. Table 2 lists the vinyl chloride concentrations at the well BOW37 wellhead from September 1996 through June 1999.

TABLE 1
DOMESTIC WELL CONTAMINANTS (HIGHEST CONCENTRATIONS)
(JUNE 1999 SAMPLING RESULTS)

Chemical/Analyte	Highest Concentration (µg/l)	Carcinogenic Screening Value (µg/l)	Non-carcinogenic Screening Value (µg/l)	Well ID	Number of Residences Served
N-Nitrate	3,600	NA	10,000 (SDWA MCL)	BOW74	1
Dichlorodifluoromethane	1.8 (P)	NA	2,000 (child RMEG) 1,000 (adult LTHA)	BOW33	1
***Vinyl chloride*☆**	***0.22***	0.02 (MTCA B)	0.2 (child chronic EMEG) 0.7 (adult chronic EMEG)	BOW37	6
1,1-Dichloroethane☆	0.2 (J)	NA	800 (MTCA B)	BOW37	6
chloromethane	0.2 (J)	3 (LTHA)	NA	BOW35 BOW96	1 1
cis-1,2-Dichloroethene☆	0.1 (J)	NA	3,000 (child Int. RMEG) 70 (MCL)	BOW37	6

µg/l = micrograms of chemical per liter of water (equals one part per billion)
CREG = ATSDR's Cancer Risk Evaluation Guide
RMEG = ATSDR's Reference Dose Media Evaluation Guide
LTHA - EPA's Lifetime Health Advisory for Drinking Water
MTCA B = WA Model Toxics Control Act Method B groundwater cleanup level
MCL = Federal Safe Drinking Water Maximum Contaminant Level
NA = Not available
EMEG = ATSDR's Environmental Media Evaluation Guide
J = estimated value between the calculated detection limit and reporting limit
P = Value is estimated, based on data validation
bolded/*italicized* compounds = compounds exceeding one or more screening value which required further evaluation
☆ - This was the only detection in a domestic well during the 6/99 sampling event

TABLE 2
VINYL CHLORIDE CONCENTRATIONS

WELL BOW37 WELLHEAD
SEPTEMBER 1996-JUNE 1999

Sample Collection Date	Concentration (µg/l)
September 1996	0.63
October 1996	0.77
April 1997	0.53
June 1997	0.32
September 1997	0.3
December 1997	0.38
March 1998	0.43
June 1998	0.39
September 1998	0.36
December 1998	0.35
March 1999	0.26
June 1999	0.22

Discussion

After evaluating all of the June sampling data, *DOH concluded that no health threat exists for people exposed for 1-5 years to any of the contaminants detected in the domestic wells. A slight increased lifetime cancer risk exists from exposure to the maximum concentration of vinyl chloride in well BOW37.* There is no apparent public health hazard. ATSDR uses the "*no apparent public health hazard*" category for sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.

Contaminants exceeding a screening value which were further evaluated

Only 1 contaminant was detected during the June 1999 sampling event which exceeded an ATSDR comparison value. Following is a discussion of that contaminant.

Vinyl Chloride

The only vinyl chloride detection this quarter was from well BOW37 at a concentration of 0.22 µg/l. Well BOW37 is located approximately 800 feet northeast of the landfill.

The reader can refer to the previous DOH health consultations prepared for this site for a detailed description of vinyl chloride toxicity, cancer, and non-cancer health effects.

Non-cancer health effects

Assuming long-term ingestion and inhalation exposure to the maximum detected concentration of vinyl chloride (0.22 µg/l), the estimated exposure dose is one half the chronic duration MRL and nearly 2,000 times lower than the LOAEL, suggesting that non-cancer health effects are not expected.

Cancer effects

The estimated increased cancer risk, assuming chronic exposure to the maximum concentration (0.22 µg/l) of vinyl chloride in drinking water from well BOW37, is slight; approximately 7 additional cancers in a population of 1,000,000 persons exposed for thirty years, averaged over a 70 year lifetime.[1]

Child Health and Developmental Effects

Vinyl chloride

[1] A review of Health District records indicate that BOW37 was initially drilled as a private well in 1976. County Assessor records indicate that homes were built and connected to the water supply in 1983, 1986, and the mid 1990s. As a result, estimated exposures, and thus risk, would be even less than this since a 30-year exposure duration was assumed for this health consultation.

A detailed discussion of developmental and reproductive effects following oral and inhalation exposure to vinyl chloride is located in the previous health consultations.

The estimated exposure doses for persons exposed to vinyl chloride at the concentration detected in well BOW37 during the June 1999 sampling event is not expected to result in adverse reproductive or developmental effects.

Conclusions

1. No health threat exists for people exposed for 1-5 years (chronically) to concentrations of contaminants detected in any of the domestic wells sampled to date, although there is a slight increase in the cancer risk for people exposed to vinyl chloride over a 30 year period.

2. Based on DOH's evaluation of all of the domestic well data provided to date, *no apparent public health hazard exists as a result of exposure to contaminants detected in any of the wells*.

Recommendations

1. Continue quarterly monitoring of domestic wells. Provide DOH with the results of the

quarterly monitoring for review and evaluation.

Actions

➤ DOH has completed six health consultations evaluating results of quarterly domestic well samples collected from April 1996 - June 1999. Quarterly monitoring continues, and Kitsap County Department of Public Works will submit the sampling results to DOH for review and evaluation. DOH will provide a verbal consultation to Ecology and the Bremerton/Kitsap County Health District summarizing the findings.

2. Well BOW37 should be monitored to observe that the concentrations of volatile organic compounds, such as vinyl chloride, do not increase in subsequent sampling events. If vinyl chloride (or other VOCs) show increasing trends or reach federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs), exposures should be reduced or eliminated (options could include treatment or an alternate water source). DOH will continue to review and evaluate quarterly well monitoring results to determine future recommendations.

Actions

➤ Well BOW37 has been sampled and evaluated, and the owner notified of the results. This well has consistently shown the highest and most frequent vinyl chloride detections, and continues to be monitored quarterly for VOCs and conventional parameters.

3. Ecology's March 1995 and March 1998 letters recommending that the Bremerton/Kitsap County Health District limit its well site approval in the areas identified in the vicinity of the landfill should be adhered to.

Actions

➤ Bremerton/Kitsap County Health District is adhering to Ecology's recommendations.

4. Should future public health intervention become necessary, DOH will work with the appropriate agencies to address the possible long-term need for an alternate water source or treatment for wells determined to be at risk.

Actions

➤ Thus far, contaminant concentrations and trends have not warranted alternate water supplies. However, DOH continues to evaluate monitoring results and will work with the appropriate agencies to address treatment options or alternate water supplies should they become necessary.

5. DOH is available to review and evaluate the results of any water samples the Bremerton/Kitsap County Health District or area residents may decide to collect from the domestic wells dropped from the Bainbridge Island landfill investigation.

Appendix A - Exposure assumptions

For this health consultation, it was assumed that residents were exposed 350 days per year, for thirty years to the contaminant concentrations highlighted in Table 1. This exposure duration was intended to account for potential past and future exposures, as well as current exposure. Exposure was assumed to be 2 liters of water per day and was assumed to occur through ingestion (drinking) and non-ingestion (inhalation and dermal contact) routes. Non-ingestion exposures are assumed to occur during household activities such as cooking, bathing, and dishwashing.

Appendix B-Exposure formulas

It is assumed that non-ingestion (inhalation and dermal) exposures are equal to exposures through ingestion.

Exposure dose = [(C x IR x EF x ED)/BW x AT)] x 2

Additional lifetime cancer risk = Estimated exposure dose x CSF

where:
C = concentration of contaminant (μg/l)
IR = Ingestion rate (liters of water/day)
EF = Exposure frequency (days/year)
ED = exposure duration (total # of years in exposure period)
BW = body weight
AT = averaging time (70 years x 365 days/year)
CSF = Cancer slope factor (Estimates the excess upperbound lifetime probability of an individual developing cancer from an exposure)

References

1. Bainbridge Island Landfill Validated Data Set for Second Quarter 1999; CH2M Hill, August 1999.

2. United States Environmental Protection Agency Integrated Risk Information System (IRIS), August 1999.

3. Toxicological Profile for Vinyl Chloride, U.S. Department of Health and Human Services, Public Health Service, ATSDR, September 1997.

4. Conversations with Barbara Trejo and Brian Sato, Washington State Department of Ecology, 1999.

5. American Cancer Society: Facts and Figures: 1998 Cancer statistics.

GLOSSARY

EMEG: ATSDR's Environmental Media Evaluation Guide. A concentration in air, soil, or water (or other environmental media), which is derived from ATSDR's MRL, and below which adverse non-cancer health effects are not expected to occur. Separate EMEGs can be derived to account for acute, intermediate, or chronic exposure durations.

RMEG: ATSDR's Reference Dose Media Evaluation Guide. A concentration in air, soil, or water (or other environmental media), which is derived from EPA's RfD, and below which adverse non-cancer health effects are not expected to occur. RMEGs account only for chronic exposure.

MRL: ATSDR's Minimal Risk Level. An estimate of daily human exposure to a dose of chemical that is likely to be without an appreciable risk of adverse noncancerous health effects over a specified duration of exposure. MRLs are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specific duration via a given route of exposure. MRLs can be derived for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.

CANCER SLOPE FACTOR: A plausible upperbound estimate of the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used to estimate an upperbound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a potential carcinogen.

LOAEL: Lowest Observed Adverse Effect Level. LOAEL's have been classified into "less serious" or "serious" effects. In dose-response experiments, the lowest exposure level at which there are statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.

MCL: Federal Maximum Contaminant Level. A drinking water regulation established by the Safe Drinking Water Act. It is the maximum permissible concentration of a contaminant in water that is delivered to the free-flowing outlet of the ultimate user of a public water system. MCLs are enforceable standards.

CARCINOGEN: Any substance that can cause or contribute to the production of cancer.

CONTAMINANT: Any substance or material that enters a system (the environment, human body, food, etc.) where it is not normally found.

MONITORING WELLS: Wells developed to collect groundwater samples for the purpose of physical, chemical, or biological analysis to determine the amounts, types, and distribution of contaminants.

MTCA: Model Toxics Control Act. Washington States hazardous waste cleanup law.